
Textile Care Research Programs in Germany

Josef Kurz

Hohenstein Institute, Boenningheim, Germany

Mr. Kurz is Business Manager of the Textile Care Research Division, and Manager of Laundry and Textile Hygiene for Hohenstein, a research institute in Germany. Under Mr. Kurz's leadership, Hohenstein established itself as the leading European textile care research institute where alternative cleaning technologies are systematically developed, studied, and evaluated. Mr. Kurz earned a Professional Engineering degree in Textile Chemistry from The Technical Academy in Hohenstein, Germany.

I have prepared my presentation with four parts: marketing data, environmental regulations, the present situation in Germany, and current and new research programs.

Marketing Data

The domestic care of apparel in Germany is about 90 percent home laundered and only 10 percent dry cleaned, wet cleaned, or washed via professional textile care. That means about 200 million articles are cleaned every year in the dry cleaning industry, or an average of 2.5 articles per capita. We also have about 2-3 kilograms of textiles per capita per year. In terms of the composition of the care properties, about 30 percent are washable and can be dry cleaned, and about 70 percent are dry clean only.

In the development of the net sales of the German dry cleaning industry, there was a decline from 1990 to 1995. I think in the United States it's similar to the German situation. In Germany, expenditure per capita for dry cleaning services is about \$13. We must ask what is the reason for this decline. The first question to ask is what has happened to the average disposable income people in Germany have to spend on things such as dry cleaning services. There has been a decline in average disposable income since 1992, so people have less money for dry cleaning services.

Another question is how have clothing habits changed (if at all) in the past few years. Slide 6 shows the development of clothing habits and the percentage or average values for formal clothing and casual clothing. From 1986 to 1996 there was a strong decline in the purchase of formal clothing and an increase in the purchase of casual clothing. Casual clothing is more washable and involves more domestic care. To summarize

this market data, there are three important possible reasons for decline in per capita expenditure for dry cleaning services: (1) decline in disposable income per capita caused by a declining economy, (2) change in clothing habits, and (3) change in the development of apparel construction.

Environmental Regulations

It is important to look at these regulations because the industry has had to invest money, and will have to invest money in the next few years to protect the environment. The two most important regulations are the Clean Air Act (similar to the Clean Air Act in the United States and Canada) and the Water Resources Acts (also similar). Slide 11 shows the dry cleaning industry and dry cleaning plants, different parts of which are regulated by different acts. The Clean Air Act regulates the machine, condensation in the machine, and the still. One difference between German and U.S. regulations, is that in Germany we have to put diffusion barriers at the wall and at the ceilings to protect the adjacent rooms from the impact of solvents such as perchloroethylene (perc). All other aspects are similar to the regulations in the United States. The Water Resources Act regulates the handling of the waste, the contact water treatment, and the figures for the drains.

The Present Situation in Germany

The following types of solvents are used: water (for washing and wet cleaning), organic solvents, perc, and petroleum solvents. In Germany as well as in the

United States, we are also doing research on carbon dioxide. With regard to wet cleaning, we have a special problem in Germany. About 30 percent of the apparel which comes to the dry cleaner every year is washable. The washability is expressed by a care labeling symbol and the dry cleaner sees that the garment can be washed. For 70 percent of the apparel there is no label that indicates that the garment can be washed, and therefore, 70 percent is dry cleaned. In reality, within this 70 percent of articles which are dry cleaned are a lot of articles which could be wet cleaned but not washed. But the dry cleaners do not know which articles can be wet cleaned. If the cleaner wet cleaned such an article and damage occurred, the dry cleaner would have to take responsibility for these damages and pay for them. If the care label indicated that these pieces could be wet cleaned, then about 20 percent of apparel could be wet cleaned by the dry cleaning industry. That means that indication of wet cleanability is essential for progress in wet cleaning all over the world. We would then only have 50 percent of apparel that would have to be dry cleaned. Perhaps we can reduce this amount by new constructions in the textile apparels.

Current and New Research Programs

When I prepared my presentation for today last week in Germany, I collected all the programs, all the research objectives we had in Germany from our colleagues in Krefeld, in industry, at Kreussler, at Hohenstein, and other places. I had a list of programs with very awfully long titles. Instead of telling you all these titles, I tried to make three groups of programs. I thought it would be a good idea to take the color of these solvents to indicate the groups. But unfortunately, all solvents are colorless. So, I looked for another color. I decided the solvents have psychological colors and not real colors. I developed the following colors and I hope you will all agree with me. The first is a Green Program that means water. And the second will be Red for perc. So with perc as a Red program, and petroleum solvents as a Yellow Program, the mixture is an Orange Program. The Blue Program is liquid or supercritical carbon dioxide.

The Green Program

The Green Program studies the applicability of water-based cleaning procedures. Despite the care labeling problem, we have two directions in which to do research work. The first one is properties of the clothing in harmony with care properties; this is a task for the apparel industry. The other one is the treatment

of clothing in dry cleaning plants—the improvement of wet cleaning technology. In regards to the harmonization of care properties, in cooperation with the apparel industry, we have to select the fabrics with regard to colorfastness, shrinkage, and surface properties. We also have to select linings, interlinings, threads, and accessories, and we have to modify design and perhaps workmanship by manufacturing the textiles for the consumer. As an example of our current research work under the Green Program, slide 19 shows two samples before and after each garment was wet cleaned seven or eight times. There was a shrinkage of the shape of the woolen garment. However, if there was an antifelting finish on this material, then the shrinkage could be avoided, or it would have been only 1 or 2 percent. Slide 20 shows a picture under the microscope of the difference between wool with and without antifelting finish. You can see the scales very sharply defined on the wool fiber and you can see a very thin layer of resin on the surface of the wool that helps it to endure the mechanical friction during the wet cleaning procedure and helps avoid the shrinkage and the felting of wool.

Another example that is very important for the development of wet cleaning is a problem with the shrinkage of rayon. If rayon has a resin finish on it, the shrinkage is very small. In regard to the clothing in dry cleaning plants, the reduction of impact on textiles and the optimization of soil removal are very important to the dry cleaner. Adequate finish processes for wet cleaned garments are also very important for the practical work in dry cleaning installations. I have one example that indicates the necessity for international cooperation. Slide 23 shows results from a round robin trial in Europe. The trial was for professional wet cleaning. It was a process for sensitive garments and they used different types of machines with different kinds of mechanical action but the same program. In one of the machines the shrinkage was 1 percent, in another it was 2 percent and both machines were operated according to the sensitive garments process. That means we have to standardize the procedures in the machines and the test methods.

The Orange Program

Perc

The hope here is to reduce the emissions in the atmosphere and ground water. The sources for emissions into air are the dry cleaning machine and the still and these are regulated by the Clean Air Act. The Water Resources Act regulates waste water and contact water management. The current research strives to develop cost effective devices to measure the concentration of perc within the dry cleaning machine. This

process must be better controlled and the final goal is a self-controlling machine. If there are any leaks in the machine, devices must tell the dry cleaner to repair the machines. The aim is to produce very cheap devices to indicate such leaks. The second objective of research is the reduction of residual perc in cleaned garments. I will give you an example of this problem. Retention of adhesives in fusible interlinings is different. Polyester and polyamide interlinings were tested for retention of perc. Slide 21 shows that two of these linings, #2 and #5 have the highest retention rate, about three or four times higher than one of the other samples. We recommend that the apparel industry not use #2 and #5. We recommend the use of interlinings that are not able to retain the perc. So, there is a tight connection between the apparel industry and the dry cleaning research facilities.

Petroleum Solvents

We have three important research directions: control of the safety aspects under practical conditions in the dry cleaning industry, minimization of the fire hazards of petroleum solvents, improvement of the energy balance by combination of distillation with absorption systems. One of these programs could be very interesting to the dry cleaners here in the room. We have a test panel of 210 machines in 180 plants. The solvents used are isoparaffins in different modifications, and the test parameters are flash point, boiling range, flash point decreasing and halogenated solvents, fatty acids, nonvolatile residue, and color.

The Blue Program

For carbon dioxide, we have a similar test program as you have in the United States and I think it would be good to have tight cooperation in the work. The approach, at the moment, in Germany is relatively wide and we are trying to find more applications for carbon dioxide than only the dry cleaning industry. It is important to study the fundamental impacts on textiles on the practical condition and the scientific research programs and then develop cost effective cleaning systems consisting of a drum, filtration unit, recovering units, and measurement devices. I know that you have in your country a machine which is new to the practice. One of the most important research goals is the improvement of cleaning efficiency. We are studying whether to use liquid carbon dioxide since all the organic solvents use a small amount of water to remove the water soluble soils. Perchloroethylene, hydrocarbon, and especially carbon dioxide in liquid form only can dissolve oil and fatty dirt from the garment but not salt and other polar substances. So we have to add 1 or 2 percent of water in order to dissolve these water soluble parts.

Perhaps, it's a long way to the Blue Program or a short way. Many people do not believe that it is possible to clean garments in carbon dioxide. For those people who ask if it is possible, I'll leave you with a quote from Geraldine Ferraro, "It was not so long ago that people thought semiconductors were part-time orchestra leaders and microchips were very, very small snack foods."

1

TEXTILE CARE RESEARCH

PROGRAMS IN GERMANY



Josef Kurz

**Hohenstein Institute, Schloss Hohenstein
D-74357 Boennigheim**

2

Contents

A Market Data

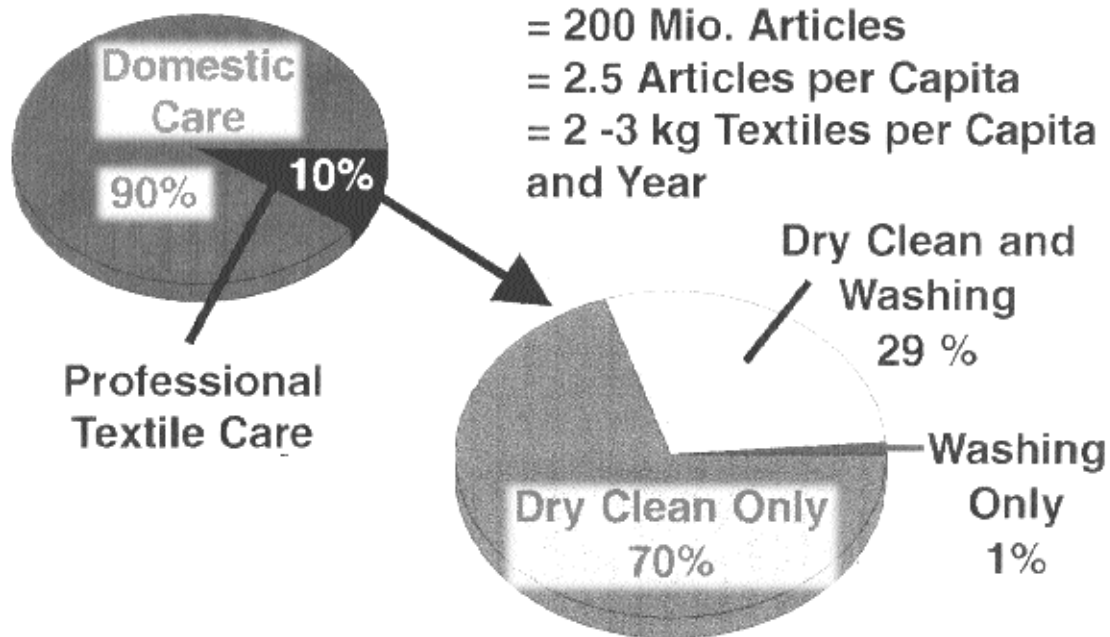
B Environmental Regulations

C Present Situation

D Current and New Research Programs

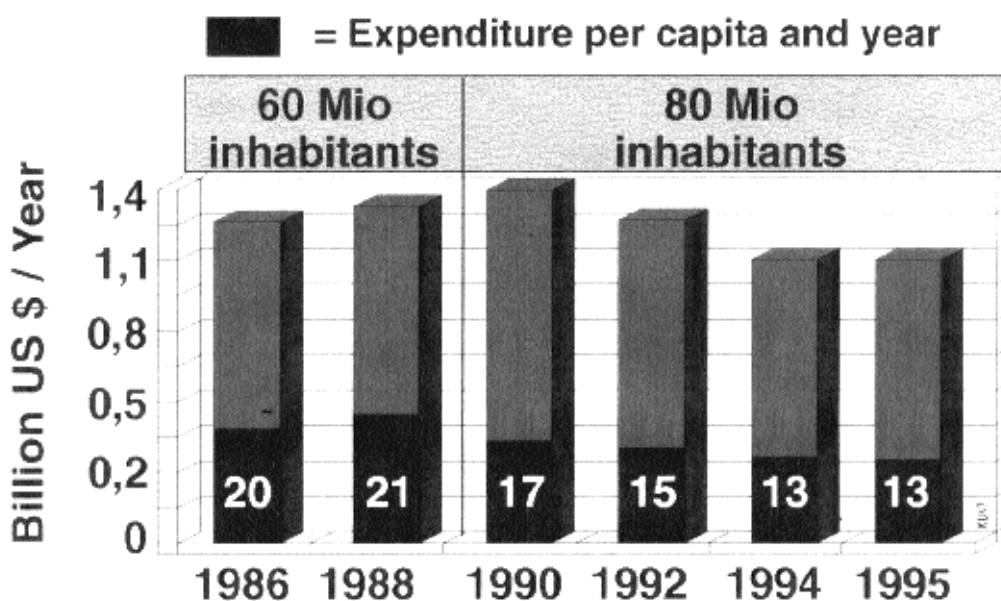
3

Volume of Clothing



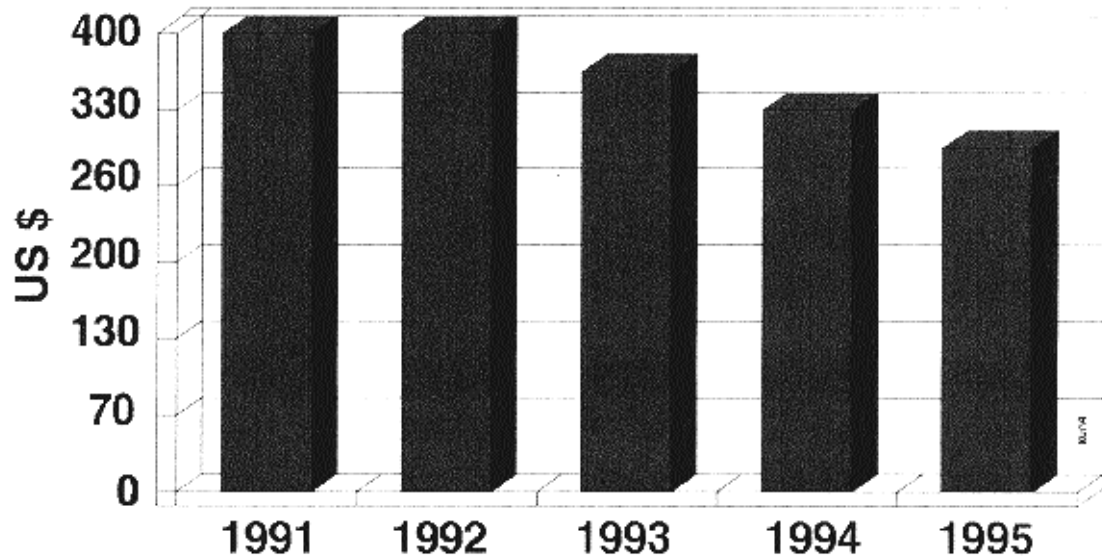
4

Net Sales of the German Dry Cleaning Industry



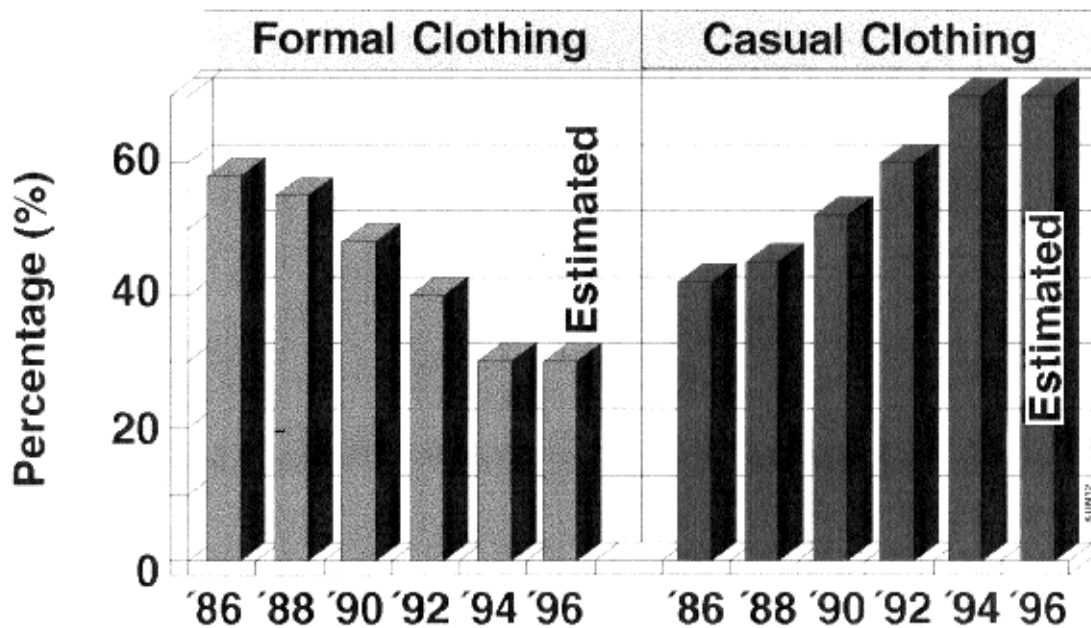
5

Average Disposable Income (per Capita)



6

Development of Clothing Habits



7

Possible Reasons for Decline in Expenditure per Capita for Dry Cleaning Services

- ▶ **Decline in disposable per capita income (caused by declining economy)**
- ▶ **Change in clothing habits**
- ▶ **Development of apparel**

8

Contents

A Market Data

B Environmental Regulations

C Present Situation

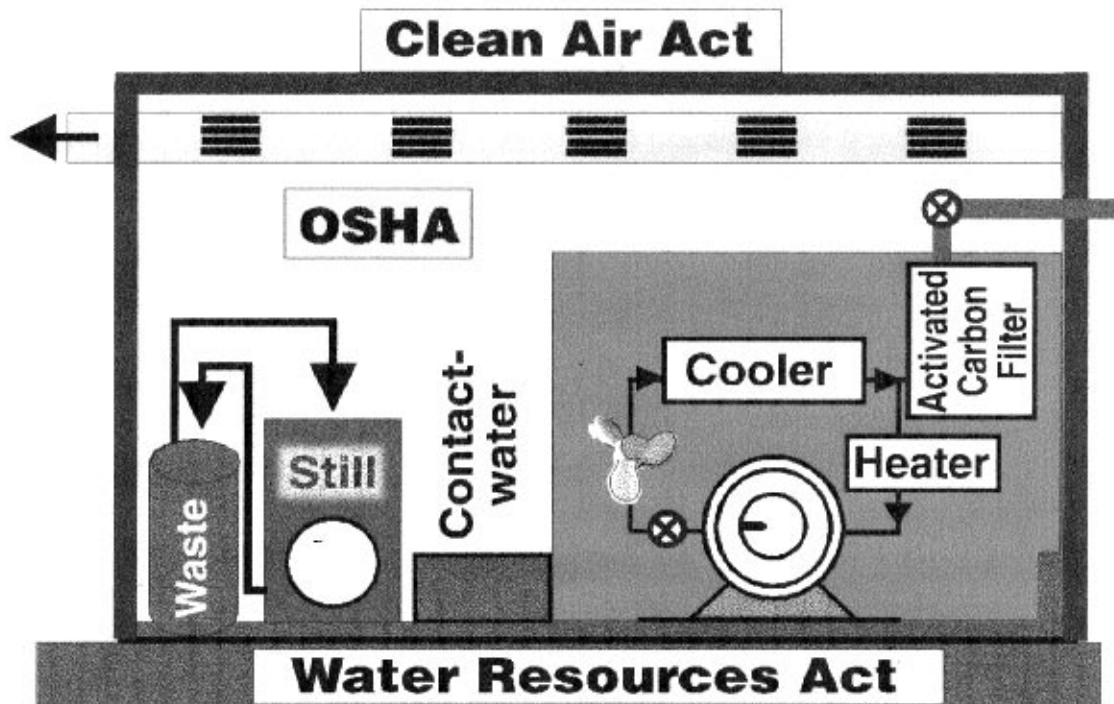
D Current and New Research Programs

9

Environmental Regulations for the Drycleaning Industry

- **Clean Air Act**
- **Water Resources Act**

10



11

Contents

A Market Data

B Environmental Regulations

C Present Situation

D Current and New Research Programs

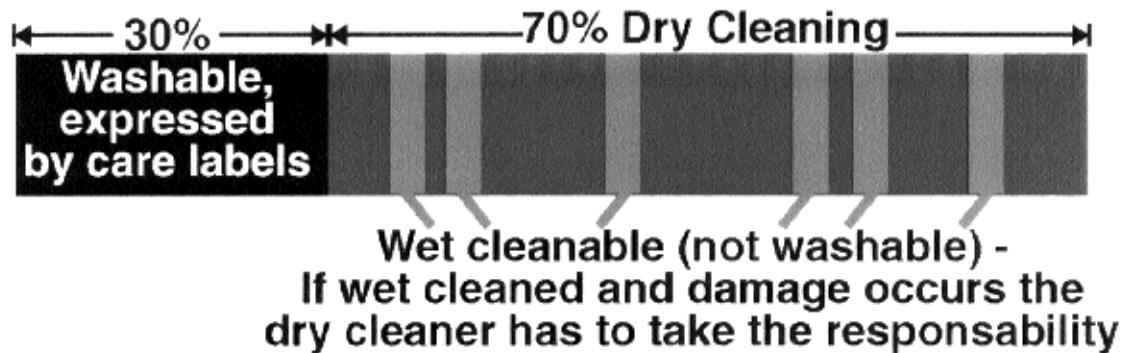
12

Present Situation "Solvents" in Dry Cleaning Industry

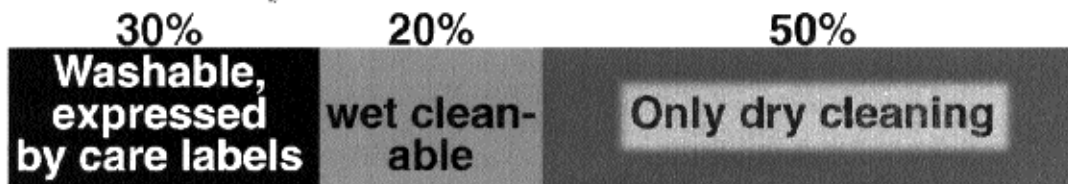
Water	Perchloroethylene	Carbon Dioxide
Washing	Dry Cleaning	in Development
Wet Cleaning	Petroleum Solvent	
	Dry Cleaning	

13

Present Situation "Wet Cleaning"



With care label for wet cleaning:



14

Contents

- A Market Data
- B Environmental Regulations
- C Present Situation
- D Current and New Research Programs

15

Research Programs

Green Program:

- Water

Orange Program:

- Organic solvents
 - Perchloroethylene
 - Petroleum Solvents

Blue Program:

- Liquid / supercritical carbon dioxide

16

Green Program

Scope:

Extension of the applicability of water based cleaning procedures

Properties of the Clothing

Harmonization of care properties

Treatment of Clothing in Dry Cleaning Plants

Improvement of wet cleaning technology

17

Green Program

Harmonization of Care Properties in Cooperation with Apparel Industry

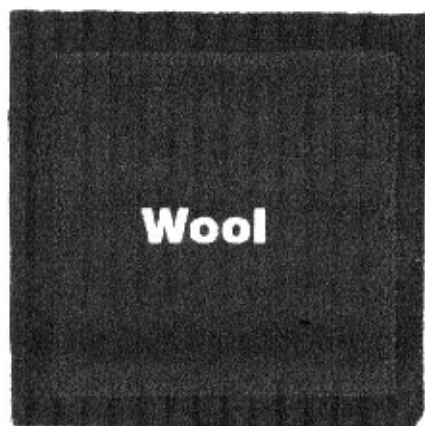
- Selection of fabrics in regard to color fastness, shrinkage and surface properties
- Selection of linings, interlinings, thread and accessories
- Design and workmanship

Period: 1996 and 1997

18

Green Program

Example



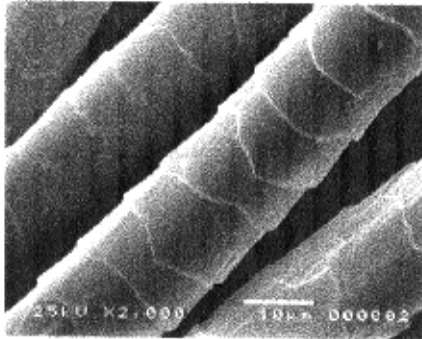
Before and after wet cleaning

19

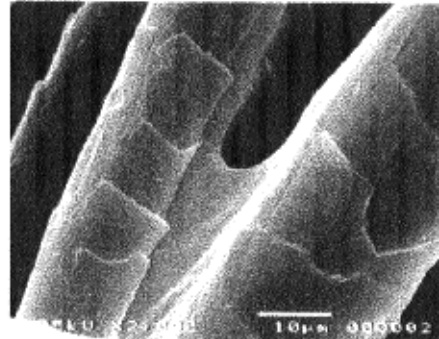
Green Program

Scanning Elektron Microscope

Magnification: x 2000



**Wool without
antifelting finish**



**Wool with
antifelting finish**

20

Green Program

Example



Before and after wet cleaning

21

Green Program

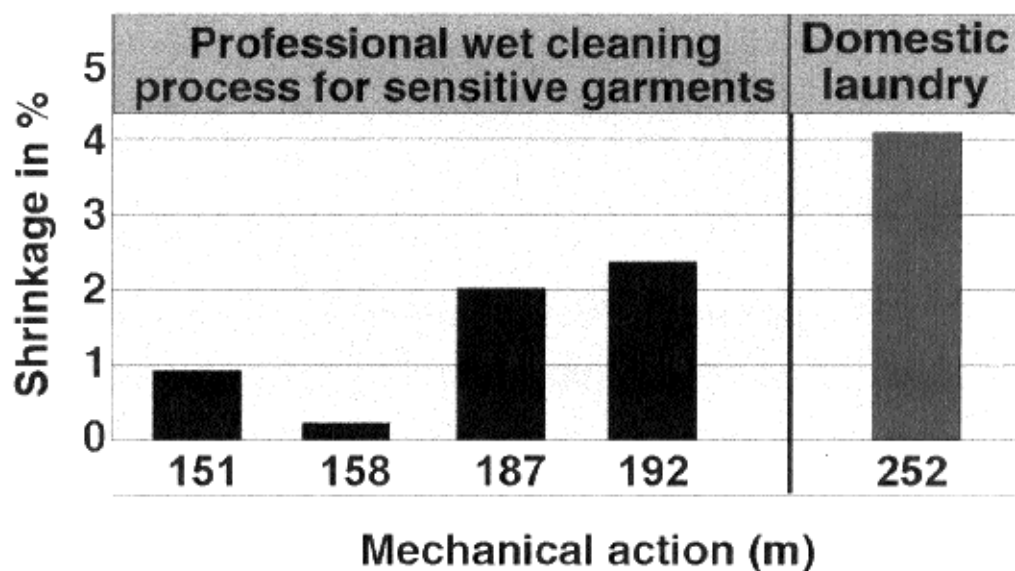
Treatment of Clothing in Dry Cleaning Plants

- Reduction of impact on textiles
- Optimization of soil removal
- Adequate finishing processes for wet cleaned garments

22

Green Program

Example



23

Orange Program

Organic Solvents - Perchloroethylene -

Scope:

**Reduction of emission into the
atmosphere and ground water**

Sources for Emission

Dry Cleaning Machine Still

**Regulated by
Clean Air Act**

Waste Contact Water

**Regulated by
Water Resources Act**

24

Orange Program

Organic Solvents - Perchloroethylene -

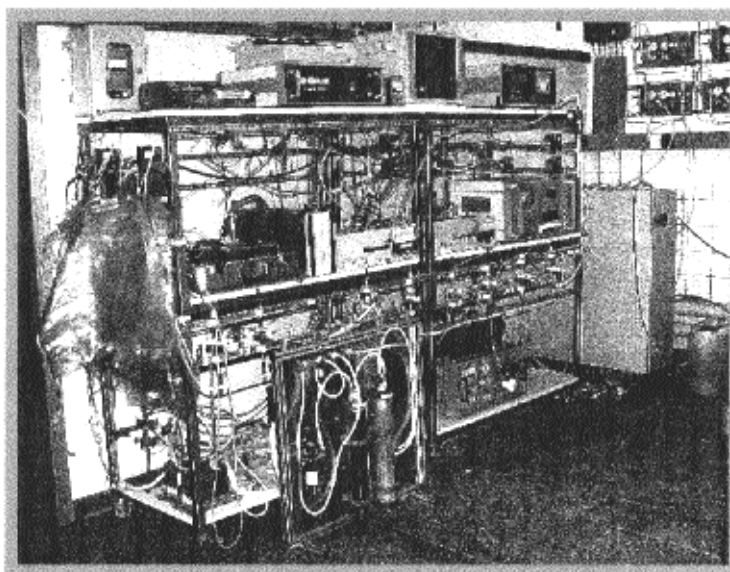
Current Research:

- **Development of cost effective devices to
measure the concentration of perchloro-
ethylene within the dry cleaning machine**
- **Reduction of residual perchloroethylene in
cleaned garments**

25

Orange Program

Organic Solvents - Perchloroethylene - Example



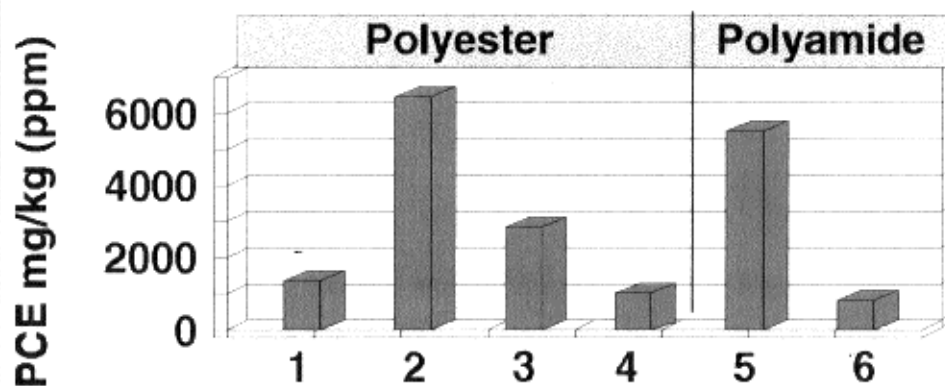
26

Orange Program

Organic Solvents - Perchloroethylene - Example

Residual Perchloroethylene in Cleaned Garments:

Retention of adhesives in fusible interlinings



Recommendation to the apparel industry:
Do not use No. 2 and 5

27

Orange Program

Organic Solvents - Petroleum Solvents -

Current Research:

- **Controlling of safety aspects under practical conditions in the dry cleaning industry**
- **Minimizing of the fire hazard of petroleum solvents**
- **Improvement of energy balance by combination of distillation with adsorption systems**

28

Orange Program

Organic Solvents - Petroleum Solvents -

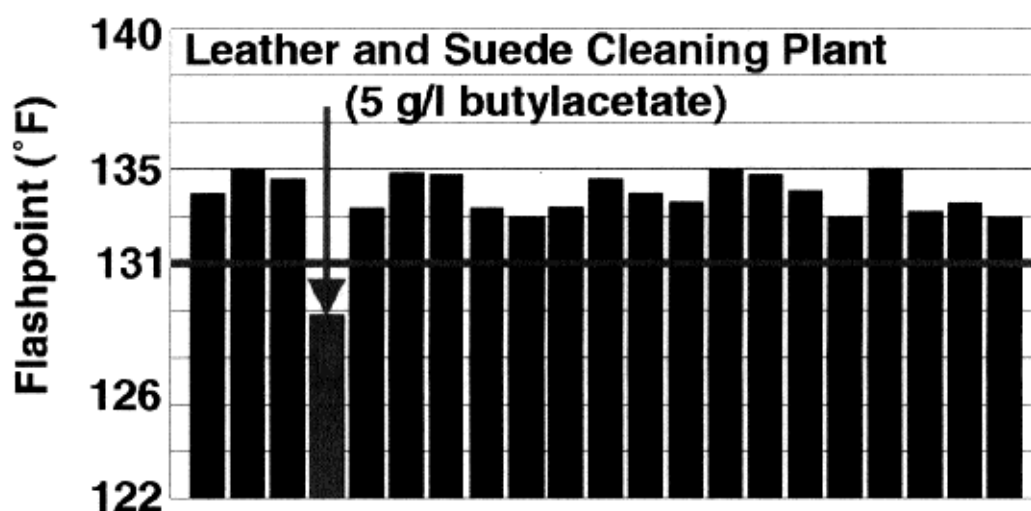
Controlling of Safety Aspects:

<u>Test Pannel:</u>	210 machines in 180 plants
<u>Solvents:</u>	Isoparaffins in different modifications
<u>Test Parameters:</u>	Flash point, boiling range, flash point decreasing and halogenated solvents, fatty acids, non-volatile residue, color

29

Orange Program

Organic Solvents - Petroleum Solvent - Example



30

Blue Program

Liquid Supercritical Carbon Dioxide

Current Research:

- Research on fundamental facts of the impact of CO₂ on apparel under practical conditions
- Development of a cost effective cleaning system consisting of drum, filtration unit, recovering unit and measurement devices
- Improvement of cleaning efficiency of the liquid resp. supercritical carbon dioxide

Blue Program

**"It was not so long ago that people
thought semiconductors were
part-time orchestra leaders
and microchips were very,
very small snack foods."**

Geraldine Ferraro

